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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/000,626	12/30/1997	RAJESH RENGARAJAN	97/P/7971/US	5591

7590 04/01/2004
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EXAMINER

TRAN, THIEN F

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 04/01/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/000,626

Applicant(s)

RENGARAJAN ET AL.

Examiner

Thien F Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 October 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 7 and 12-25 is/are pending in the application.
- 4a) Of the above claim(s) 12-23 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7, 24 and 25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Objections

Claim 4 is objected to because of the following informalities: line 3, "said nitride layer" should be --said nitride liner-- for lack of antecedent basis and to be consistent with claim 4 as original filed. Appropriate correction is required.

Claim 5 is objected to because of the following informalities: line 2, "said liner, substantially on a top" should be --said nitride liner, substantially to a top-- to be consistent with claim 5 as original filed. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-5, 7, 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuda (JP 57-159038 of record) in view of Lou et al. (USPN 5,872,045 of record), Wolf (reference U of record), and Hamada (USPN 5,972,778).

Fukuda discloses a trench isolation structure (Figs. 4a-4e) comprising a V-shaped trench in a substrate 10; a nitride liner 12' recessed within the trench and the nitride liner forming a partially enclosed volume; an oxide layer 11' formed within the trench, the oxide layer underlying the nitride liner 12'; a polysilicon 5 to fill in the trench; and an oxide layer 11 on the top surface of the substrate. Fukuda does not disclose using a dielectric material of oxide to fill the trench. However, both polysilicon and oxide

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are materials known in the art and routinely used to fill trench isolation structure as shown for example by Lou et al. wherein the trench isolation structure is formed with an oxide or polysilicon filling the trench (col. 1, lines 35-60). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to select any one of these materials as a suitable trench fill in the device of Fukuda, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of design choice. In re Leshin, 125 USPQ 416. As a result, the modified Fukuda has the oxide fill formed above the nitride liner and no polysilicon material is formed within the trench.

Fukuda further discloses an uppermost surface of the nitride liner 12' being recessed to a first depth. Fukuda does not explicitly disclose the first depth being greater than a transistor channel depth of a transistor beside the trench isolation structure. However, it is old and well known in the art that shallow trench isolation structures are formed in the substrate to isolate and define an active region that includes a conventional transistor in a well comprising source/drain regions that define a channel region. Therefore, the incorporation of a conventional transistor in a well of an active region beside the trench isolation structure is prima facie obvious. Also, it is old and well known in the art that shallow trench isolation region is notoriously formed much deeper than source/drain regions in order to effectively isolate active regions that include channel regions defined by source and drain regions, as shown for example by Wolf (a shallow trench isolation structure formed in the substrate about 5000-8000 angstroms deep) (page 45, line 28) and Hamada (channel depth in the range of 200 to

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1500 angstroms). With the channel region always formed very shallow near a top surface of a substrate as suggested by Hamada, the trench isolation region formed with a depth at least 5 times deeper than that of the channel region as suggested by Wolf and the nitride liner formed at the bottom of the trench as taught by Fukuda, it is obvious that the modified Fukuda's device provides a nitride liner having its first depth greater than the transistor channel depth.

Regarding claim 2, Fukuda does not specifically disclose a conventional P-FET transistor. It is old and well known in the art to form trench isolation structure in the support circuitry with conventional P-FET transistors generally employed.

Regarding claim 3, with the trench isolation formed 5000 - 8000 angstroms deep below the substrate surface as suggested by Wolf together with Fukuda showing the uppermost surface of the nitride liner 12' being recessed to a first depth of about half the distance of the trench depth (the first depth is 2000 - 4000 angstroms), the combination teachings of Fukuda, Wolf and Hamada show the nitride liner having its uppermost surfaces recessed to a first depth greater than about 1000 angstroms below a top surface of the substrate.

Also, it would have been obvious to select the depth of the uppermost surface of the nitride liner since it depends on the trench depth. The trench depth may vary with specific designs. Trench depth in semiconductor devices is an art recognized variable of importance which is subject to routine experimentation and optimization. Accordingly, it would be well for one within ordinary skill in the art to select the first depth of the uppermost surface of the nitride liner as taught by Fukuda in association with the trench

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depth selection. Also, the application contains no disclosure of either the critical nature of the claimed dimension or any unexpected results arising therefrom. In *re Daily*, 93 USPQ 47 (CCPA 1966), the court held that changes in size and shape of parts of an invention in the absence of an unexpected result involve routine skill in the art.

Additionally, In *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), the Federal Circuit held that where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device. Furthermore, the application provides no indication that this particular chosen dimension is unconventional. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimension is critical. In *re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ 2d 1934, 1936 (Fed. Cir. 1990).

Regarding claim 4, the modified Fukuda discloses an oxide layer 11' disposed within the trench and underlying the nitride liner 12'; and an oxide fill instead of polysilicon fill disposed above the nitride liner such that the nitride liner is encapsulated by the oxide fill and oxide layer.

Regarding claim 5, the oxide fill extends above the uppermost surface of the nitride liner, substantially to a top surface of the substrate, such that substantially no voids exist above the uppermost surface of the nitride liner.

Regarding claims 7 and 25, it is conventional to fill the trench isolation with an oxide fill of TEOS. Therefore, the incorporation of an oxide fill of TEOS into the device of Fukuda is *prima facie* obvious.

The claim limitation "for preventing hot carrier effects due to charge trapping" in the claim preamble of claim 24 specifies an intended use or field of use is treated as nonlimiting since it has been held that in device claims, intended use must result in a structural difference between the claim invention and the prior art in order to patentably distinguish the claim invention from the prior art. If the prior art structure is capable of performing the intended use, then it meets the claim. *In re Casey*, 152 USPQ 235 (CCPA 1967); *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). Also, a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

The claim limitations "to prevent hot carrier effects due to charge trapping ... transistor" in claims 1 and 24; and "polysilicon material used in other processing is prevented from entering the trench" are functional languages. It has been held that claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danley*, 120 USPQ 528, 531 (CCPA 1959). "Apparatus claims cover what a device is, not what a device does." *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990). A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be

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employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987). Furthermore, the modified Fukuda has the claimed structure wherein the uppermost surface of the nitride liner is recessed to a first depth that is greater than a transistor channel depth and the oxide fill is disposed above the nitride liner; therefore, it is inherent that the modified Fukuda would have performed the claimed functions. Hot carrier effects due to electrical charge trapped in the silicon nitride liner is prevented because the nitride liner formed below the channel depth.

Response to Arguments

Applicant's arguments with respect to claims 1-5, 7, 24-25 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thien F Tran whose telephone number is (571) 272-1665. The examiner can normally be reached on 8:30AM - 5:00PM Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C Lee can be reached on (571) 272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

tt
March 24, 2004


THIEN TRAN
PRIMARY EXAMINER